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CASE REPORT

Prenatal Diagnosis of Fetal Schizencephaly by Ultrasonography and Magnetic Resonance Imaging

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Schizencephaly is a rare disease with a grave prognosis. Prenatal diagnosis is extremely important for perinatal management and consultation. Here, we present a rare case of fetal schizencephaly detected *in utero* using prenatal ultrasound and magnetic resonance imaging. The case was confirmed after birth by postnatal magnetic resonance imaging. We believe our case could provide useful information and an additional reference for obstetricians.

Introduction

Schizencephaly is defined as a fluid-filled cavity in the fetal brain, which may be in communication with the lateral ventricle and subarachnoid space [1—4]. The terminology of schizencephaly is often used interchangeably with porencephaly, porencephalic cyst, cystic brain degeneration, and congenital brain clefts [1—4].

In pathogenesis, schizencephaly is proposed as a congenital brain malformation of cortical development in the fetus. In addition, schizencephaly is also considered as a destructive process of the fetal brain related to vascular injury [2]. The clefts of fetal schizencephaly may extend through the hemispheres from the ventricles to the pial surface. Two types of fetal schizencephaly are most common: the clefts may be in contact (closed-lip), or widely separated (open-lip) [4].

Clinically, schizencephaly is a rare diagnosis in prenatal medicine. Most cases of schizencephaly are diagnosed after 28 weeks gestation. To date, schizencephaly has never been reported before 20 weeks gestation [2—4]. The prognosis of fetal schizencephaly is usually grave, therefore, antenatal ultrasound (US) and magnetic resonance imaging (MRI) are important in assisting early diagnosis of schizencephaly, and prenatal consultation as well as management.

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Case report

A 23-year-old woman, gravida 2, para 1, was referred to National Cheng Kung University Hospital for decreased fetal movement and fetal ventriculomegaly. She had an unremarkable past medical and family history. However, she had no prenatal care during this pregnancy until 33 weeks gestation when ventriculomegaly was revealed by her first ultrasound scan by another hospital.

Initial examination at our hospital revealed normal maternal blood pressure of 100/56 mmHg. Maternal laboratory data were all normal, including hemoglobin 9.1 g/dL, hematocrit 28.4%, platelet count 455,000/μl, prothrombin time 10.50 seconds, active partial thromboplastin time 20.20 seconds. In addition, maternal serum creatinine and alanine transaminase were within normal limits. She denied any history of trauma. Congenital infection survey did not reveal any positive congenital infections.

At our clinic, fetal heart rate monitoring revealed a normal rate of 130—150 bpm with smooth baseline variability, and tocometry showed irregular uterine contractions.

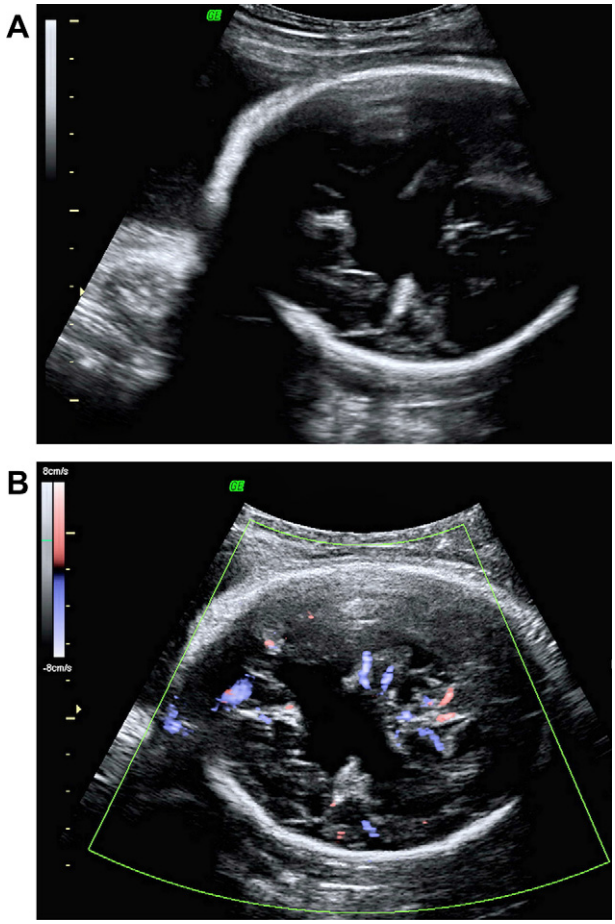

Fig. 1 Fetal head ultrasound at 33 weeks gestation revealed irregular hypoechoic cerebral space-occupying lesion without blood flow. (A) Irregular hypoechoic cerebral space-occupying lesion revealed by two-dimensional US. (B) Cerebral space-occupying lesion without blood flow revealed by high-definition color Doppler US.

US examination showed an average-for-gestational-age fetus, with biparietal diameter of 7.7 cm (31 weeks), abdominal circumference of 28.4 cm (34 weeks), and femoral length of 6.4 cm (34 weeks). The systolic/diastolic ratio of the umbilical artery was within normal limits (3.29). An irregular hypoechoic cerebral space-occupying lesion without blood flow was demonstrated (Fig. 1A and B). The cystic lesion was located between both lateral ventricles, and no midline shifting was noted. The flow of the Circle of Willis was well preserved (Fig. 2A and B). Fetal schizencephaly with intracranial hemorrhage was suspected.

Fetal MRI at 33 weeks gestation depicted bilateral brain clefts in both frontal lobes, with more on the left side. The corpus callosum was preserved. No fat or subacute hematoma was visible and the midline was centrally located. Besides, cystic dilatation at the temporal horn of the right lateral ventricle was revealed. The space-occupying lesion divided the fetal brain into two parts, and fetal schizencephaly was diagnosed (Fig. 3A and B).

After genetic consultation, the parents decided to keep this baby and planned to deliver at another hospital. At 34 + 5 weeks gestation, a live preterm female baby was delivered through spontaneous vaginal delivery at another hospital, with a birth weight of 2560 g, Apgar score 6 and 9 at 1 minute and 5 minutes, respectively. After birth,

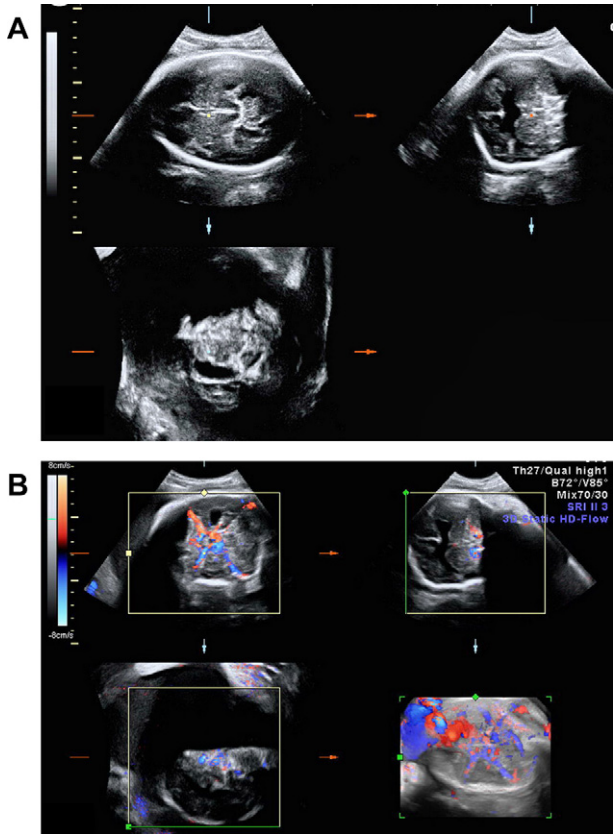

Fig. 2 3D US revealed the lesion of fetal schizencephaly at 33 weeks. (A) Multiplanar orthogonal view by 3D US. (B) Three planes and rendering modes of fetal brain by 3D color Doppler US. 3D US = three dimensional ultrasound.

opisthotonos (Fig. 4) and abnormal eye contact emerged. No seizure was observed.

Recurrent newborn fever occurred, therefore, the baby was admitted to our neonatal intensive care unit for further treatment. Clinically, the baby presented with diabetes insipidus, fever, and seizure. Postnatal MRI demonstrated bilateral schizencephaly, with right-side closed lip and left-side open lip (Figs. 5A, B, 6 and 7). In addition, septo-optic dysplasia was noted, with atrophic bilateral optic nerves and optic chiasma (Fig. 8), absence of septum pellucidum, and thinning of corpus callosum.

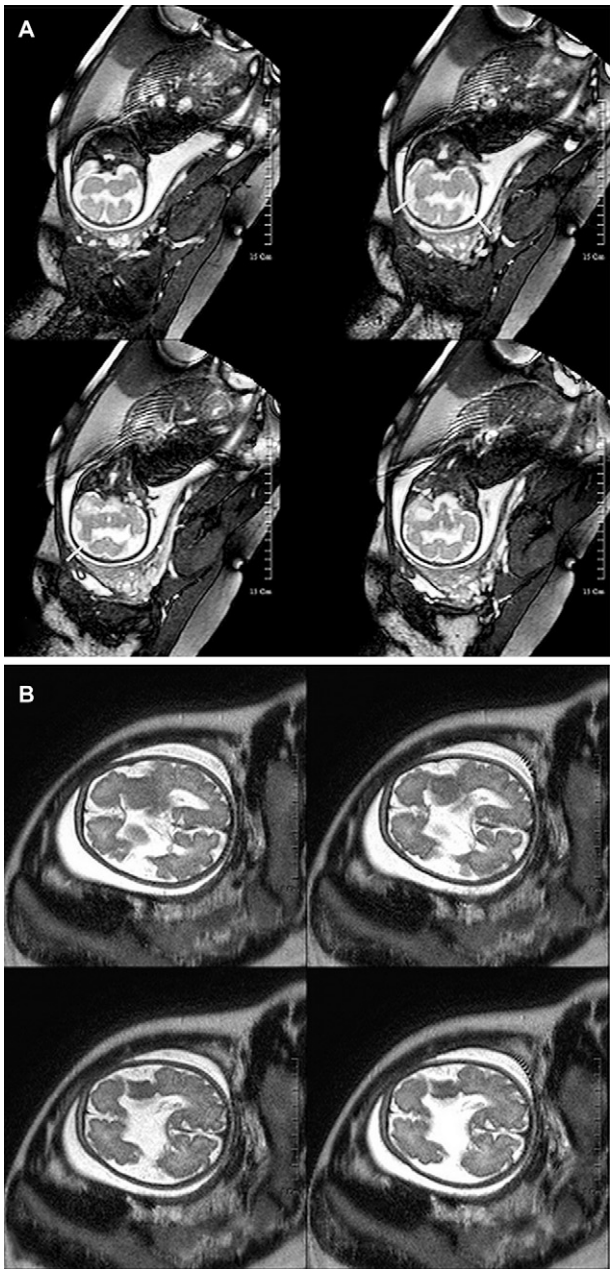

Fig. 3 Fetal magnetic resonance imaging at 34 weeks gestation revealed brain clefts in both frontal lobes, with more on the left side. (A) Corpus callosum was preserved. No fat or subacute hematoma was visible and midline was centrally located. (B) Cystic dilatation at the temporal horn of the right lateral ventricle. The space-occupying lesion divided the fetal brain into two parts.

Discussion

According to previous published research, the incidence of schizencephaly is estimated to be 1.54 in 100,000 live births, and most cases are diagnosed after birth [4]. Antenatal diagnosis of schizencephaly is rare. Besides, most cases of schizencephaly are diagnosed after 28 weeks gestation, and schizencephaly has never been diagnosed before 20 weeks gestation, to the best of our knowledge. To date, only three antenatally detected cases have been identified at 21 weeks gestation and none before 20 weeks [5]. In the present case, schizencephaly was diagnosed at 33 weeks gestation due to absence of prenatal care. Prenatal US depicted a large intracranial space-occupying lesion and schizencephaly was diagnosed. Fetal MRI revealed schizencephaly, and postnatal MRI confirmed our initial diagnosis by using US.

Our case indicated that prenatal US is important for detecting fetal schizencephaly. Fetal MRI also contributes to the diagnosis of fetal schizencephaly. From our case, we cannot conclude which tool is better than the other. We believe that both US and MRI are important in the prenatal diagnosis of fetal schizencephaly, and one cannot replace the other. Rather, they are complementary to each other. We recommend using US and MRI for prenatal diagnosis of fetal schizencephaly whenever possible.

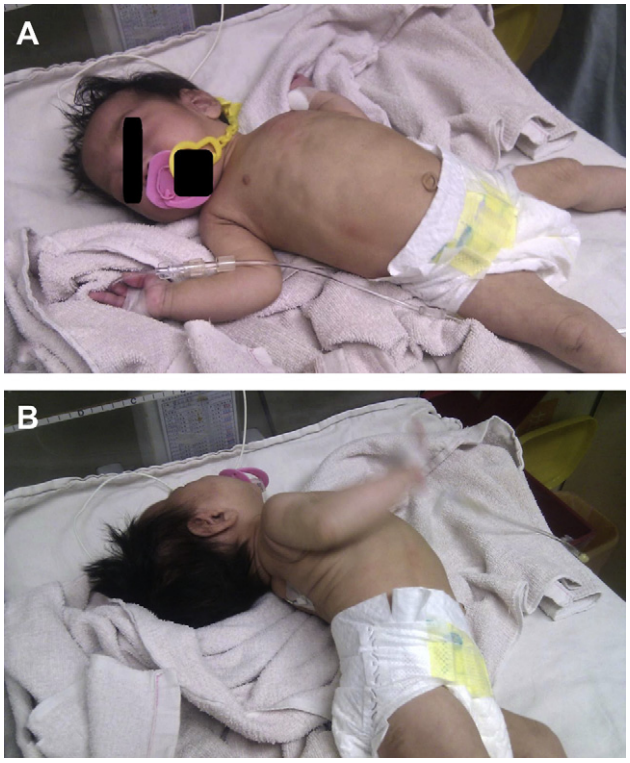

Fig. 4 Neonatal opisthotonos, a condition in which the body is held in an abnormal position with rigid and arches the back, with the head thrown backward. (A) Frontal view; (B) lateral view.

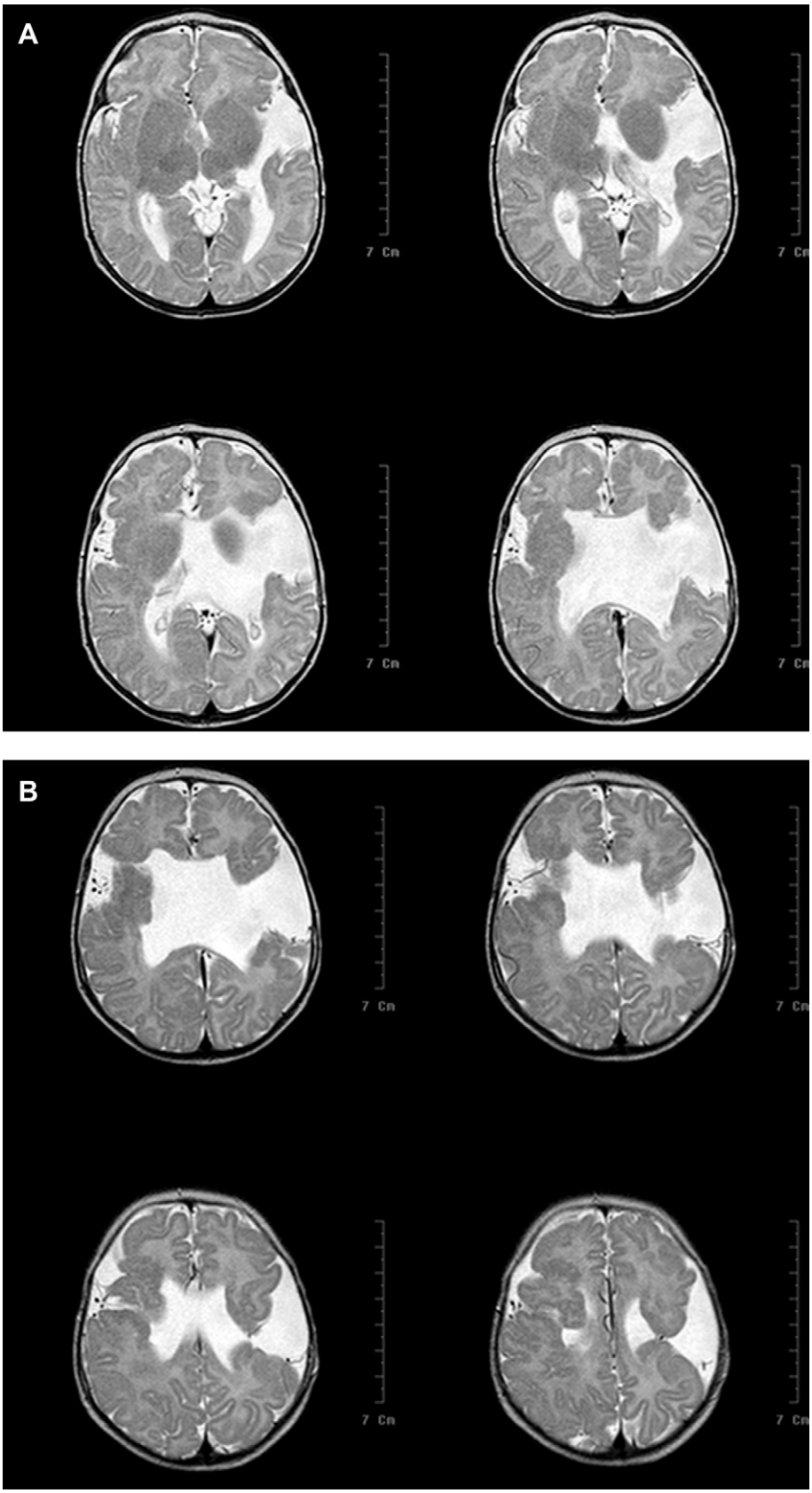

Fig. 5 Postnatal magnetic resonance imaging revealed bilateral schizencephaly, right closed lip and left open lip (transverse view, T2-weighted image). (A) Main part of the left-side lesion. (B) Main part of the right-side lesion.

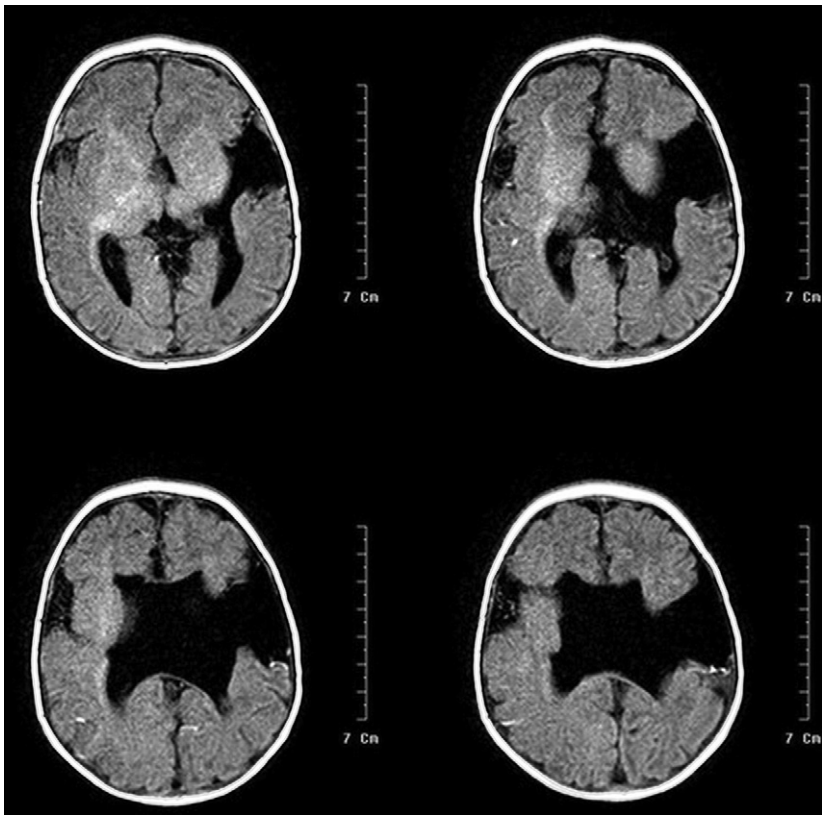

Fig. 6 Postnatal magnetic resonance imaging revealed bilateral schizencephaly, right closed lip and left open lip (transverse view, T1-weighted image).

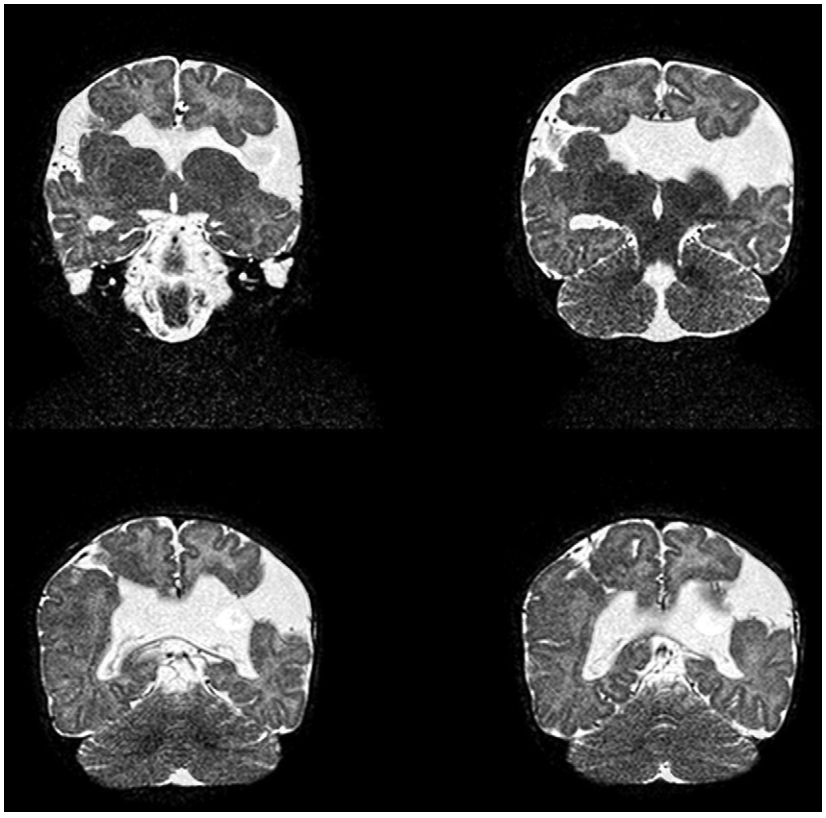

Fig. 7 Postnatal magnetic resonance imaging revealed bilateral schizencephaly, right closed lip and left open lip (Coronal view, T2-weighted image).

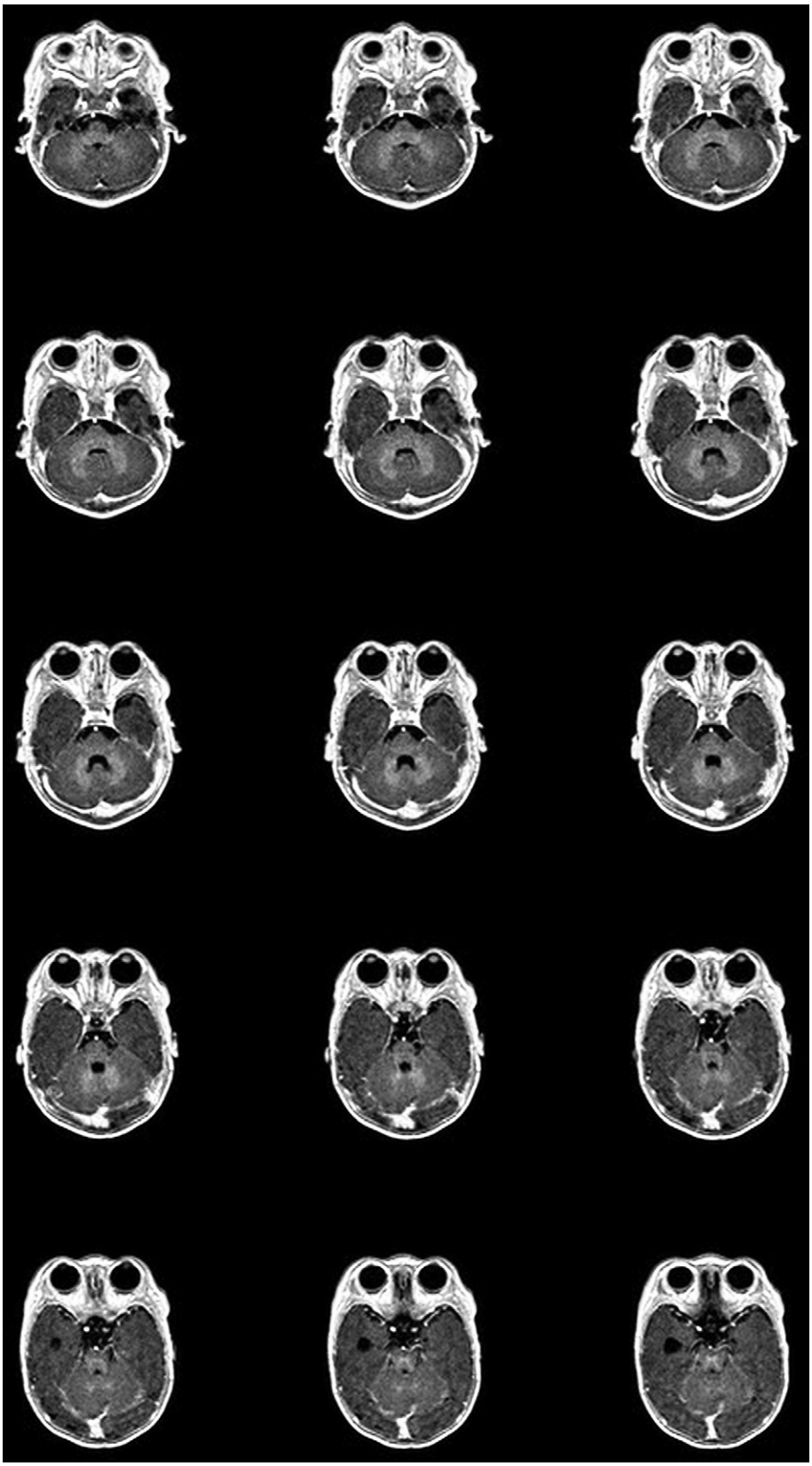

Fig. 8 Postnatal magnetic resonance imaging revealed atrophic bilateral optic nerves and optic chiasma (transverse view, T1-weighted image).

Etiologically, schizencephaly is a malformation of cortical development [4]. Yet, progressive destructive processes are also proposed [4]. In addition, schizencephaly is also reported to be related to toxins, maternal warfarin [5], cytomegalovirus infection [6,7], genes, fetal brain vascular injury or vascular anomalies, following trauma and amniocentesis [8], alloimmune thrombocytopenia [9,10], and in association with various syndromes [11]. In this case, we did not observe maternal cytomegalovirus infection, thrombocytopenia, drugs or toxin exposure. In our case, a progressive destructive process was the most likely pathogenesis of schizencephaly. However, further studies and follow-up in the future are needed for this case.

The prognosis of schizencephaly is related to the extent of the lesion [4]. Schizencephaly may result in motor retardation, mental impairment, seizures, and developmental delay. In the present case, the baby presented with diabetes insipidus, recurrent fever and seizure in the neonatal period. Developmental delay will be followed in the future.

In conclusion, fetal schizencephaly is a rare disease, yet with an extremely grave prognosis. Prenatal diagnosis of schizencephaly is crucial for prenatal management and consultation. We believe our case could provide a useful reference for prenatal diagnosis of schizencephaly in maternal—fetal medicine.

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